

**The Project Gutenberg eBook of Geographic Variation in the Pocket Gopher,
Thomomys bottae, in Colorado, by Phillip M. Youngman**

This ebook is for the use of anyone anywhere in the United States and most other parts of the world at no cost and with almost no restrictions whatsoever. You may copy it, give it away or re-use it under the terms of the Project Gutenberg License included with this ebook or online at www.gutenberg.org. If you are not located in the United States, you'll have to check the laws of the country where you are located before using this eBook.

Title: Geographic Variation in the Pocket Gopher, Thomomys bottae, in Colorado

Author: Phillip M. Youngman

Release date: September 5, 2011 [EBook #37317]
Most recently updated: January 8, 2021

Language: English

Credits: Produced by Chris Curnow, Joseph Cooper, Erica Pfister-Altschul and the Online Distributed Proofreading Team at <https://www.pgdp.net>

*** START OF THE PROJECT GUTENBERG EBOOK GEOGRAPHIC VARIATION IN THE POCKET GOPHER, THOMOMYS BOTTAE, IN COLORADO ***

UNIVERSITY OF KANSAS PUBLICATIONS
MUSEUM OF NATURAL HISTORY

[pg 363]

Volume 9, No. 12, pp 363-384, 7 figs, in text, 1 table
February 21, 1958

**Geographic Variation
in the Pocket Gopher, Thomomys bottae,
in Colorado**

BY
PHILLIP M. YOUNGMAN

UNIVERSITY OF KANSAS
LAWRENCE
1958

UNIVERSITY OF KANSAS PUBLICATIONS, MUSEUM OF NATURAL HISTORY

[pg 364]

**Editors: E. Raymond Hall, Chairman, Henry S. Fitch,
Robert W. Wilson**

**Volume 9, No. 12, pp. 363-384, 7 figs. in text, 1 table
Published February 21, 1958**

UNIVERSITY OF KANSAS
Lawrence, Kansas

PRINTED IN
THE STATE PRINTING PLANT
TOPEKA, KANSAS
1958



27-1765

[pg 365]

Geographic Variation in the Pocket Gopher, *Thomomys bottae*, in Colorado

BY
PHILLIP M. YOUNGMAN

INTRODUCTION

Two species of pocket gophers of the genus *Thomomys* (Family Geomyidae) occur in Colorado, *Thomomys bottae* (see fig. 1) in the low valleys in the south-central and southwestern parts of the state and *Thomomys talpoides* mainly in the mountains and high valleys.

Thomomys bottae occurs primarily in the Piñon-juniper, Ponderosa Pine, and Short Grass zones of Daubenmire (1943) but in some localities is found in the Douglas Fir Zone. *Thomomys talpoides* occupies primarily the Douglas Fir Zone and Engelmann Spruce-Subalpine Spruce Zone but is found also in the Piñon-juniper and Short Grass zones in some localities.

The ranges of the two species do not overlap in the strict sense but interdigitate in a parapatric type of distribution.

Two other pocket gophers, *Geomys bursarius* and *Cratogeomys castanops*, also occur in Colorado—in the Upper Sonoran Life-Zone. *Geomys bursarius* occupies much of the Great Plains, whereas *Cratogeomys castanops* is found only on the plains in the southeastern part of the state.

The objectives of the study, reported on here, were to learn the geographic distribution of *Thomomys bottae* in Colorado, to find means for recognizing the different subspecies, and to describe individual and geographic variation.

I am indebted to Mr. Sydney Anderson and Professor E. Raymond Hall for many helpful suggestions and for their critical reading of the manuscript, to Dr. Richard S. Miller, who made the collection of many of the specimens possible, and to Dr. Richard M. Hansen for numerous suggestions. I wish to express my appreciation also to the following for the loan of specimens in their care: Alfred M. Bailey and A. A. Rogers, Colorado Museum of Natural History, Denver, Colorado; David H. Johnson, United States National Museum, Washington, D. C; Robert W. Lechleitner, Colorado State University, Fort Collins, Colorado; and Robert Z. Brown, Colorado College, Colorado Springs, Colorado.

METHODS

[pg 366]

Adults of approximately equal age were compared in the study of geographic variation. Three criteria of adulthood are: (a) suture obliterated between supraoccipital and exoccipital, (b) suture at least partly obliterated between basisphenoid and basioccipital, (c) supraorbital crests not widely separated and almost parallel. In males the crests encroach on the lateral borders of the interparietal; in females the crests approach the lateral borders of the interparietal but are more widely separated than in males.

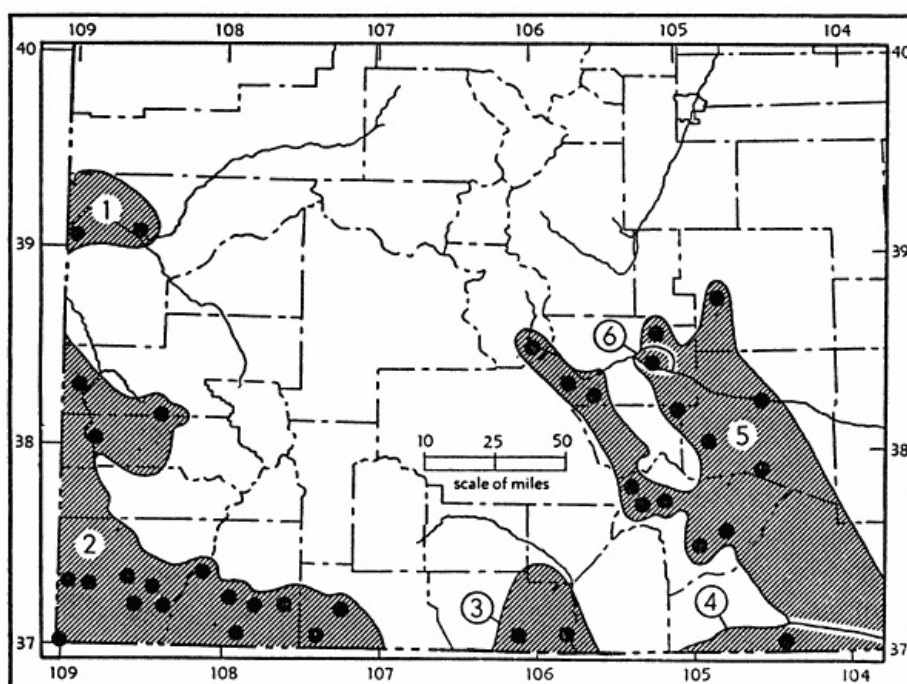


FIG. 1. Geographic distribution of *Thomomys bottae* in southwestern Colorado.

1. *T. b. howelli*

2. *T. b. aureus*
3. *T. b. pervagus*
4. *T. b. cultellus*
5. *T. b. internatus*
6. *T. b. rubidus*

In studying geographic variation, greater emphasis was placed on females than on males. As noted by Grinnell (1931:4), males vary more than females, especially in length of rostrum and associated nasal measurements.

Color terms are those of Munsell (1954). Color measurements were standardized by the use of a single 100 watt General Electric blue daylight bulb in a 12 inch white reflector suspended 24 inches above the specimen. All other light was excluded. The individual hairs of *Thomomys bottae* are either bicolored or tricolored. The darkness of a specimen often may be attributed to the presence of dark-tipped hairs. The color given in the description is the basic reddish or yellowish color of the hairs. The presence of a grizzled effect or a dark dorsal stripe, or any other pattern resulting from dark hairs, is noted in the remarks.

Specimens examined are listed by counties in the following order:

[pg 367]

Mesa
 Montrose
 San Miguel
 Dolores
 Montezuma
 La Plata
 Archuleta
 Conejos
 Chaffee
 Fremont
 El Paso
 Pueblo
 Custer
 Huerfano
 Alamosa
 Las Animas

Localities are listed from north to south within a county. If two localities lie on the same line of latitude, the western precedes the eastern. Localities omitted on the map in order to prevent overlapping of symbols are in *Italics*. Unless otherwise indicated, specimens are in the University of Kansas, Museum of Natural History. The following initials are used to designate specimens in other collections:

CSU—Colorado State University, Fort Collins, Colorado.

CMNH—Colorado Museum of Natural History, Denver, Colorado.

ERW—E. R. Warren Collection, Colorado College, Colorado Springs, Colorado.

USNM—United States National Museum, Washington, D. C.

The following measurements of the skull are listed in the tables:

Condylbasal length.—The shortest distance between the anteriormost projections of the premaxillaries and a line touching the posterior surfaces of the exoccipital condyles.

Length of nasals.—The distance from the most anterior projection of the nasal bones to the most posterior projection of a nasal bone.

Zygomatic breadth.—The greatest distance across the zygomatic arches, at right angles to the long axis of the skull.

Squamosal breadth.—The greatest distance between the mastoidal processes of the squamosal.

Length of rostrum.—The shortest distance from the shallow notch that lies lateral to the hamulus of the lacrymal bone, to the tip of the nasal on the same side of the skull.

Breadth of rostrum.—The greatest width of the rostrum, anterior to the maxillae, transverse to the long axis of the skull.

Alveolar length of upper maxillary tooth-row.—Distance between the anterior margin of the alveolus of the first cheek-tooth and the posterior margin of the alveolus of the last upper cheek-tooth, on one side of the skull.

Least interorbital breadth.—The least distance across the frontal bones at the interorbital constriction as seen in dorsal view.

Thomomys bottae occurs in the Colorado Plateau Province (terminology of Fenneman, 1931), the Southern Rocky Mountain Province and a small part of the Great Plains Province.

The Colorado Plateau Province, in the southwestern part of the state, is mostly above 5000 feet and is characterized by the great number of canyons cut by rivers and streams in the nearly horizontal strata. Prominent features of the landscape are cuervas, such as Mesa Verde, and laccoliths, such as Ute Peak.

The Southern Rocky Mountain Province consists mainly of high granitic mountains running north and south, many of which extend to more than 14,000 feet above sea level. Included in this region are several large basins, such as North Park and South Park and the San Luis Valley. The San Juan Mountains, which separate the Colorado Plateau Province from the San Luis Valley, and the Sangre De Cristo and Wet mountains, which intervene between the San Luis Valley and the Great Plains, importantly influence the distribution of *Thomomys bottae*.

[pg 368]

The Great Plains Province is a broad highland that slopes gradually eastward from the Rocky Mountains. Of importance to the present study are two subdivisions of the Great Plains, the Colorado Piedmont and the Raton Section.

The Colorado Piedmont is a much dissected fluvial plain, roughly extending from the vicinity of the Arkansas River to the northern boundary of the state. In general the topography of the Colorado Piedmont is broadly rolling with greater relief than the high plains to the east; however, buttes and steep bluffs occur locally.

The Raton Section imperceptibly blends into the southern boundary of the Colorado Piedmont and extends south into New Mexico and Texas. A trenched peniplane of greater relief and altitude than the Colorado Piedmont, it is characterized by high mesas, extensive dissected lava-capped plateaus, deep canyons, and mountains of volcanic origin.

GEOGRAPHIC VARIATION

Six subspecies of *Thomomys bottae* occur in Colorado. *T. b. aureus* and *T. b. howelli* occupy the Colorado Plateau Province (see fig. 1) and are characterized by a yellowish color; nasals posteriorly truncate or rounded; posterior extensions of premaxillae long; basioccipital wide; and interpterygoid space U-shaped with a median spicule.

T. b. internatus, *T. b. cultellus*, and a new subspecies from the vicinity of Cañon City described on page 376, inhabit the Sangre De Cristo and Wet mountains in the Southern Rocky Mountain Province and adjacent parts of the Colorado Piedmont and Raton Section of the Great Plains Province (see fig. 1). This group of closely related subspecies is characterized by reddish color; posterior margins of nasals forming a V; posterior extensions of premaxillae short; basioccipital narrow; and interpterygoid space V-shaped, lacking a median spicule.

T. b. pervagus occupies part of the San Luis Valley to the west of the Rio Grande (see fig. 1). In Colorado *T. b. pervagus* is isolated from *T. b. internatus* and *T. b. cultellus* by the Sangre De Cristo and Culebra ranges and is separated from *T. b. aureus* by the San Juan Mountains. *T. b. pervagus* occupies an area geographically intermediate between *T. b. aureus* to the west and *T. b. internatus* and *T. b. cultellus* to the east and has some characters in common with these subspecies. *T. b. pervagus* resembles *T. b. aureus* in having long posterior extensions of the premaxillae and in sometimes having rounded posterior margins of the nasals. *T. b. pervagus* resembles *T. b. internatus* and *T. b. cultellus* in color, the presence of a V-shaped interpterygoid space, and a narrow basioccipital. Kelson (1951:69) has pointed out that in New Mexico the separation of the ranges of *T. b. pervagus* and *T. b. cultellus* is probably complete, but probably incomplete between *T. b. pervagus* and *T. b. aureus*. Nevertheless, the similarities between *T. b. pervagus* and *T. b. cultellus* and *T. b. internatus* suggest that *T. b. pervagus* was originally derived from the more eastern stock.

[pg 369]

T. b. aureus is a variable subspecies which, according to Durrant (1952:211), intergrades with *T. b. howelli* in Utah. Specimens of *T. b. aureus* showing the greatest amount of geographic variation cranially are from the ecotone between the Piñon-juniper and Douglas Fir zones at the edge of the range of the subspecies.

T. b. howelli is a markedly distinct subspecies that shows certain similarities to *T. b. aureus*, but the degree of cranial difference from *T. b. aureus* suggests an isolation of long duration, or a rapid evolution from the parent stock.

T. b. internatus and *T. b. cultellus* probably intergrade east of the Sangre De Cristo Range in the vicinity of the Colorado-New Mexico boundary. The amount of intergradation is obscured by the great amount of geographic variation occurring in *T. bottae* at the edge of the plains and by the lack of specimens from this area.

T. b. internatus is a widespread subspecies showing its greatest variation at the edge of the plains. This area is an ecotone between the coniferous forest and the grassland and is by nature an area of change owing to the alternation of wet and dry periods such as the pluvial, interpluvial, and postpluvial periods. This seems to support Durrant's observation (1952:496) that "the greatest range of morphological variation is in animals from the least stable environments."

Specimens from a small area north of the Arkansas River in the vicinity of Cañon City (see fig. 1) differ sufficiently from *T. b. internatus* to be given nominal recognition. High mountains and the Arkansas River isolate the new subspecies found at Cañon City from populations of *T. b. internatus* to the west and south; however there are no apparent geographic barriers between the newly named subspecies and populations of *T. b. internatus* twelve miles to the north or from the vicinity of Pueblo to the east. This new subspecies is the most extreme of the variants occurring in the unstable environment at the edge of the plains.

Thomomys bottae aureus Allen

Thomomys aureus Allen, Bull. Amer. Mus. Nat. Hist., 5:49, April, 1893; Warren, Colorado College Publ., 19:252, January, 1906; Warren, Colorado College Publ., 33:77, January, 1908; Warren, Mammals of Colorado, p. 79, 1910; Cary, N. Amer. Fauna, 33:136, August 17, 1911.

Thomomys bottae aureus, Goldman, Proc. Biol. Soc. Washington, 48:156, October 31, 1935; Warren, Mammals of Colorado, p. 158, 1942.

Thomomys apache Bailey, Proc. Biol. Soc. Washington, 23:79, May 4, 1910. Holotype from Lake La Jara, 7500 feet, Rio Arriba County, New Mexico.

Thomomys perpallidus aureus, Bailey, N. Amer. Fauna, 39:74, November 15, 1915.

Thomomys perpallidus apache, Bailey, N. Amer. Fauna, 39:75, November 15, 1915.

Thomomys bottae apache, Goldman, Proc. Biol. Soc. Washington, 48:157, October 31, 1935; Warren, Mammals of Colorado, p. 160, 1942.

Thomomys bottae optabilis Goldman, Jour. Washington Acad. Sci., 26:116, March 15, 1936. Holotype from Coventry, 6500 feet, Montrose County, Colorado; Warren, Mammals of Colorado, p. 159, 1942, part.

Holotype.—Adult female, skin and skull number 5243/4123, American Museum of Natural History, obtained at Bluff City, San Juan County, Utah, May 12, 1892, by Charles P. Rowley.

Distribution.—Colorado Plateau Province of southwestern Colorado (see fig. 1), northwestern New Mexico, southeastern Utah, and northeastern Arizona.

Distinctive characters.—Size large (see measurements); usually pale in western part of range, dark in eastern part; posterior extensions of premaxillae long, wide, and deeply serrated; posterior margins of nasals truncate or slightly rounded (see fig. 2); interpterygoid space U-shaped, with median spicule; basioccipital wide; bullae well inflated, rounded ventrally.

Comparisons.—For comparisons with *T. b. howelli* and *T. b. pervagus*, see accounts of those subspecies.

Remarks.—*T. b. aureus* is a variable subspecies, which differs considerably from *T. b. internatus*, *T. b. cultellus*, and *T. b. rubidus* and includes several microgeographic races distinguishable to a taxonomist specializing in the group. These slightly varying populations are here not considered sufficiently distinct for nominal recognition.

Characters such as color of the pelage and conformation of the bullae and zygomatic arches vary with the locality, and to some extent vary among specimens from a single locality.

The name *Thomomys bottae optabilis*, given to specimens from Coventry by Goldman (1936:116), is here placed in synonymy under *T. b. aureus* Allen. The characters originally used to describe *T. b. optabilis* are of the type that vary between populations only a few miles apart, or often vary within a population. The skulls of specimens from Coventry are not lighter in structure than those of *T. b. aureus*. The premaxillae are not narrower, nor is the frontal region narrower or more constricted than in *T. b. aureus*.

The name *Thomomys bottae apache*, given to specimens from Lake La Jara, New Mexico, by Bailey (1910:79), and later applied to specimens from Colorado by Bailey (1915:75), is here also placed in synonymy under *T. b. aureus*. Specimens from Lake La Jara, New Mexico, and nearby localities in Colorado may be separated from topotypes of *T. b. aureus* on the basis of color only. The topotypes of *T. b. aureus* are mostly pale; some, however, are dark. The number of pale specimens in any given series decreases gradually in a clinal pattern from west to east. Since there is no noticeable step in the cline and since all specimens show close cranial similarity, it is felt that nominal recognition of the darker specimens does not present a realistic picture of the relationships of the relatively unisolated populations in the Colorado Plateau Province.

Since *Thomomys bottae* in the Colorado Plateau Province is especially plastic, varying from locality to locality, emphasis is here placed on similarities that unite specimens from different localities. The individual and microgeographic variations are outlined below.

Specimens from Bedrock have zygomatic arches that are heavy anteriorly. Specimens from

Coventry are dorsally almost uniformly Strong Brown (7.5YR 5/6) and lack a strong dorsal stripe. The venters are Reddish Yellow (7.5YR 8/6). Specimens from 15 miles west of Cortez are the palest specimens of *T. b. aureus* from Colorado, and closely resemble topotypes. The basic color varies from Reddish Yellow (7.5YR 7/6 and 6/6) to Strong Brown (7.5YR 5/6). Specimens are marked with a narrow dark dorsal stripe. The venters are white. Specimens from Ute Peak and Cortez have Reddish Yellow (7.5YR 6/6) flanks and are slightly darker dorsally. Many specimens from Mesa Verde are indistinguishable from specimens from Coventry and from Cortez. Others have dark diffuse dorsal stripes. The venters are Pink (7.5YR 7/4) or Pinkish White (7.5YR 8/2). Some specimens from the Mancos River have wide dorsal stripes. Specimens from three miles west of Durango have especially wide-spreading zygomatic arches posteriorly and have wide black dorsal stripes. The venters are Pink (7.5YR 7/4). One specimen from Florida is dark and grizzled and has a dark dorsal stripe. Another specimen is pale and has only a small dorsal stripe. Specimens from 12 miles west of Pagosa Springs have thin rostra and diffuse dorsal stripes. Specimens from Bondad have a V-shaped interpterygoid space and in it a small median spicule. One specimen is uniformly grizzled and lacks a dorsal stripe, giving an overall effect of Dark Yellowish Brown (10YR 3/3). Another specimen has Strong Brown (7.5YR 5/6) flanks and is only slightly darker dorsally.

[pg 372]

Specimens examined.—Total 114. *Colorado*: Montrose Co.: West Paradox Valley, 5 (CMNH); Bedrock, 5150 ft., 5 (ERW); Coventry, 6800 ft., 14 (12 ERW, 2 USNM). San Miguel Co.: 19 mi. N Dove Creek, 6100 ft., 1. Montezuma Co.: *Ashbaugh's Ranch* (T.36N, R.18W) 5350 ft., 5 (4 ERW, 1 USNM); 15 mi. W Cortez (Sec. 2, T.35N, R.19W), 5400 ft., 8; Major Ranch, Cortez, 7 (CSU); 3 mi. SSW Cortez, 6400 ft., 1; Ute Peak, 2 (CMNH); Four Corners, 1 (CMNH). Mesa Verde National Park: Upper Well, Prater Canyon, 7575 ft., 1; 3/4 mi. S, 1-3/4 mi. W Park Point, 8000 ft., 3; 1/4 mi. N Middle Well 7500 ft., 1; Sec. 27, Head of E Fork, Navaho Canyon, 7900 ft., 2; 1-1/4 mi. S, 1-3/4 mi. W Park Point, 8000 ft., 1; Middle Well, Prater Canyon, 7500 ft., 9; 3 mi. N Rock Springs, 8200 ft., 4; 1-1/2 mi. S, 2 mi. W Park Point, 8075 ft., 1; 2-1/2 mi. N, 1/2 mi. W Rock Springs, 8100 ft., 3; 2 mi. N, 1/4 mi. W Rock Springs, 7900 ft., 2; 1/2 mi. N Far View Ruins, 7825 ft., 1; Far View Ruins, 7700 ft., 1; 1 mi. NNW Rock Springs, 7500 ft., 1; Rock Springs, 7400 ft., 1; Mancos River, 6200 ft., 9; *Mesa Verde*, 1 (USNM). *La Plata Co.*: 1 mi. N La Plata, 1; 3 mi. W Durango, 5; *Florida*, 6800 ft., 5; Bayfield, 1 (USNM); Bondad, 6 (CMNH); *Archuleta Co.*: 12 mi. W Pagosa Springs, 6700 ft., 2; Arboles, 1 (USNM). *New Mexico*: Rio Arriba Co.: La Jara Lake, 7500 ft., 2 (USNM).

***Thomomys bottae howelli* Goldman**

Thomomys bottae howelli Goldman, Jour. Washington Acad. Sci., 26:116, March 15, 1936; Warren, Mammals of Colorado, p. 161, 1942.

Thomomys aureus, Cary, N. Amer. Fauna, 33:136, August 17, 1911, part.

Thomomys perpallidus aureus, Bailey, N. Amer. Fauna, 39:74, November 15, 1915, part.

Holotype.—Adult female, skin and skull, number 75684, United States National Museum, obtained by Arthur H. Howell at Grand Junction, 4600 feet, Mesa County, Colorado, November 7, 1895.

Distribution.—Colorado Plateau Province of west-central Colorado and east-central Utah, in the Colorado River Valley east of the Green River (see fig. 1).

Distinctive characters.—Pale (Pinkish White 7.5YR 8/2); cranium flattened; nasals short and wide; posterior tongues of premaxillae long, thin, and attenuate (see fig. 3).

Comparisons.—Compared with *T. b. aureus*, *T. b. howelli* differs as follows: paler; nasals shorter and wider; cranium more flattened; posterior extensions of premaxillae longer, thinner, and more acuminate.

Remarks.—*T. b. howelli* most closely resembles *T. b. aureus*; however, since only one adult specimen of *T. b. howelli* is known, it is impossible to appraise adequately its characters. Durrant (1952:211) records intergradation between *T. b. howelli* and *T. b. osgoodi*, and between *T. b. howelli* and *T. b. aureus* in Utah.

An attempt to collect specimens of *T. b. howelli*, in March, 1957, by Richard S. Miller and the writer was unsuccessful.

[pg 373]

Specimens examined.—Total 2. Mesa Co.: Grand Junction, 4600 ft., 1 (USNM); Sieber Ranch, Little Doloris River, 1 (ERW).

***Thomomys bottae pervagus* Merriam**

Thomomys aureus pervagus Merriam, Proc. Biol. Soc. Washington, 14:110, July 19, 1901; Cary, Proc. Biol. Soc. Washington, 20:26, March 27, 1907; Warren, Colorado College Publ., 33:77, January, 1908; Warren, Mammals of Colorado, p. 79, 1910, part; Cary, N. Amer. Fauna, 33:137, August 17, 1911, part.

Thomomys bottae pervagus, Goldman, Proc. Biol. Soc. Washington, 48:157, October 31, 1935.

Thomomys fulvus pervagus, Bailey, N. Amer. Fauna, 39:82, November 15, 1915.

Holotype.—Adult male, skin and skull, number 58293, United States National Museum, Espanola, Rio Arriba County, New Mexico, obtained by J. Alden Loring, January 4, 1894.

Distribution.—Upper Rio Grande and San Luis valleys of the Southern Rocky Mountains, in northern New Mexico and southern Colorado (see fig. 1).

Distinctive characters.—Yellowish Red (5YR 4/6); size large (see measurements); posterior tongues of premaxillae long, thin, and acuminate; nasals long, thin, posterior margins usually forming a wide V (see fig. 4); bullae rounded ventrally; interpterygoid space V-shaped, lacking median spicule.

Comparisons.—From *T. b. aureus*, *T. b. pervagus* differs as follows: reddish, never yellowish or blackish; posterior tongues of premaxillae thin and not deeply serrated; posterior margins of nasals forming a shallow V; interpterygoid space V-shaped, lacking a median spicule; basioccipital narrow. For comparisons with *T. b. internatus*, *T. b. cultellus*, and *T. b. rubidus*, see accounts of those subspecies.

Remarks.—*T. b. pervagus* is a well-defined subspecies. There is little variation between the topotypes and specimens from Colorado.

Specimens examined.—Total 20. *Colorado*: Conejos Co.: *Antonito*, 5 (USNM); 7 mi. E *Antonito*, 2 (USNM); 12 mi. E *Antonito*, 1 (USNM); Conejos River, 6 mi. W *Antonito*, 8300 ft., 2 (USNM). *New Mexico*: Rio Arriba Co.: *Espanola*, 10 (USNM).

***Thomomys bottae internatus* Goldman**

Thomomys bottae internatus Goldman, Jour. Washington Acad. Sci., 26:115, March 15, 1936; Warren, Mammals of Colorado, p. 160, 1942; Kelson, Univ. Kansas Publ., Mus. Nat. Hist., 5:63, October 1, 1951.

Thomomys aureus pervagus, Warren, Mammals of Colorado, p. 80, 1910, part; Cary, N. Amer. Fauna, 33:137, August 17, 1911, part.

Thomomys fulvus pervagus, Bailey, N. Amer. Fauna, 39:82, November 15, 1915, part.

Holotype.—Adult male, skin and skull, number 150997, United States National Museum, obtained at Salida, 7000 feet, Chaffee County, Colorado, by Merritt Cary, November 10, 1907.

Distribution.—Southern Rocky Mountain Province; southwestern part of the Colorado Piedmont, and Raton Section of the Great Plains, to the east of the Sangre De Cristo Range (see fig. 1).

[pg 374]

Distinctive characters.—Yellowish Red (5YR 5/6.5); size medium (see measurements); posterior tongues of premaxillae short; posterior margins of nasals forming a V (see fig. 6); bullae pointed ventrally; interpterygoid space V-shaped, lacking a median spicule; basioccipital narrow.

Comparisons.—From *T. b. pervagus*, topotypes of *T. b. internatus* differ as follows: uniformly paler, not so reddish; smaller; skull smaller; posterior tongues of premaxillae shorter; bullae smaller, less inflated, and more pointed ventrally; zygomata less angular.

For comparisons with *T. b. cultellus* and *T. b. rubidus*, see accounts of those subspecies.

Remarks.—The dividing line between *T. b. internatus* and *T. b. cultellus* is drawn arbitrarily since only one specimen has been collected between La Veta Pass and the border of New Mexico.

When Goldman (1936:115) named *T. b. internatus* he included specimens from Union and Colfax counties, New Mexico, and specimens from Gardner, Colorado (not Garfield as stated by Kelson, 1951:66). The specimens from New Mexico and a specimen from Fishers Peak, Colorado, were subsequently assigned to *T. b. cultellus* by Kelson (*loc. cit.*).

The specimen from Fishers Peak shows some characters that might be interpreted as intermediate between *internatus* and *cultellus*, but shows also some unique characters that can be understood only by further collecting in the regions north and northeast of the type locality of *T. b. cultellus*.

Variation is slight in the large series of topotypes of *T. b. internatus*. Specimens from other localities in the western part of the range differ little from the topotypes. Specimens from one mile west of Coaldale have slightly more inflated bullae that are more flattened ventrally. Specimens from five miles south of Cotopaxi also have the bullae more flattened ventrally.

Specimens from localities bordering the plains differ from the topotypes and near topotypes, and in general show greater variation from locality to locality. Specimens from 12 miles north of Cañon City are dark, resembling *T. b. rubidus*, but cranially agree with specimens from near Colorado Springs in being indistinguishable from specimens from Salida. Specimens from St. Charles Mesa and Bear Creek near Walsenburg differ from the topotypes in having wider rostra. The specimens from St. Charles Mesa have more inflated bullae.

Specimens examined.—Total 93. Chaffee Co.: 2 mi. NNW Salida, 7100 ft., 3; *Salida*, 28 (20 ERW, 8 USNM). Fremont Co.: 12 mi. N Cañon City, 5; 1 mi. W Coaldale, 8; *Cotopaxi*, 1 (CSU); 5 mi. S *Cotopaxi*, 12. El Paso Co.: 1-1/4 mi. S Colorado Springs, 2; 9 mi. SSW Colorado Springs, 2; 17 mi. S Colorado Springs, 1. Custer Co.: 2-1/2 mi. S Wetmore, 3; Santa Fe Drive and 20th Lane, Blende, 1; St. Charles Mesa, 5600 ft., 2 (CSU); Fork of Huerfano and Cucharas rivers, 2 (CMNH). Huerfano Co.: 11 mi. WNW Gardner, 7000 ft., 3; Gardner, 7000 ft., 2 (USNM); 1-1/2 mi. S Redwing, 3; Bear Creek, near Walsenburg, 2 (CSU); 1 mi. E La Veta, 8; 5 mi. SE La Veta, 2.

[pg 375]

Thomomys bottae cultellus Kelson

Thomomys bottae cultellus Kelson, Univ. Kansas Publ., Mus. Nat. Hist., 5:64, October 1, 1951.

Thomomys fulvus, Cary, Proc. Biol. Soc. Washington, 20:26, March 27, 1907; Warren, Colorado College Publ., 33:76, January, 1908; Warren, Mammals of Colorado, p. 80, 1910.

Thomomys fulvus fulvus, Bailey, N. Amer. Fauna, 39:80, November 15, 1915.

Holotype.—Adult male, skin and skull, number 70919, United States National Museum, Halls Peak, Mora County, New Mexico; January 13, 1895, obtained by C. Barber.

Distribution.—Raton Section of the Great Plains in northern New Mexico and extreme southern Colorado (see fig. 1).

Distinctive characters.—Dark (topotypes); size medium (see measurements); posterior tongues of premaxillae short; posterior margins of nasals forming a V (see fig. 5).

Comparisons.—From *T. b. pervagus*, topotypes of *T. b. cultellus* differ as follows: darker, not so reddish; smaller; skull smaller; zygomatic arches relatively longer; bullae proportionately smaller and less inflated; basioccipital proportionately wider; posterior tongues of premaxillae shorter.

Topotypes of *T. b. cultellus* most closely resemble those of *T. b. internatus* but differ as follows: darker; zygomatic arches more widely spreading, not so nearly parallel; nasals not so wide; bullae slightly more inflated.

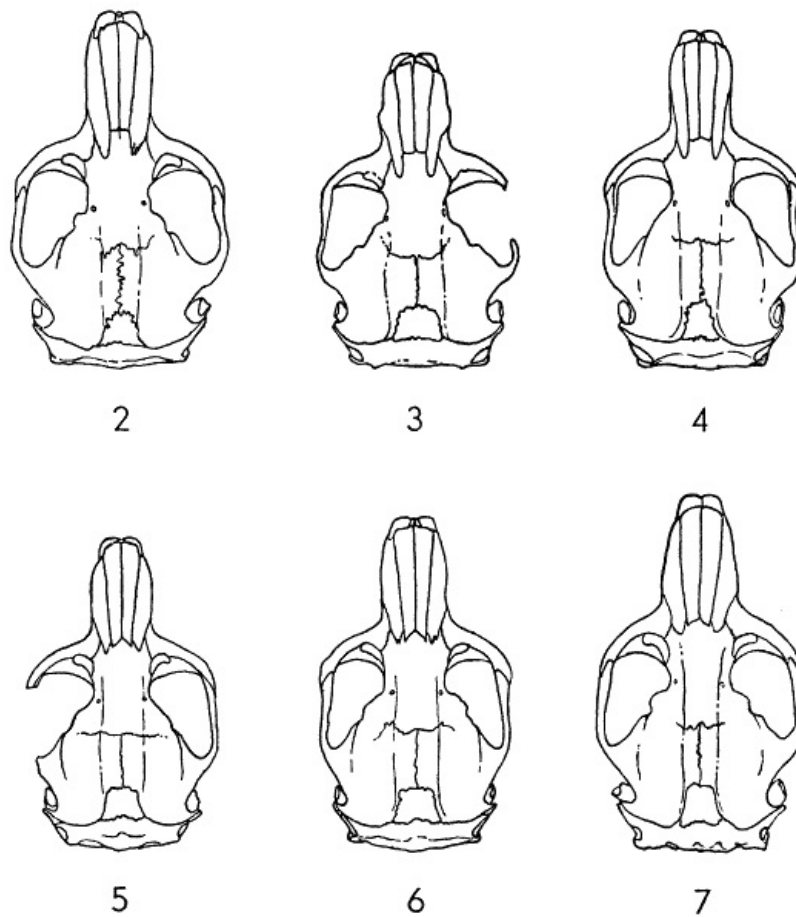
For a comparison with *T. b. rubidus* see the account of that subspecies.

Remarks.—Kelson (1951:64) named *T. b. cultellus* on the basis of six dark specimens (Dark Reddish Brown 5YR 3/4 and 2/2). Nowhere else within the range of this subspecies, as defined by Kelson, do any specimens resemble the topotypes in color.

After comparing topotypes of *T. b. cultellus* with topotypes of *T. b. internatus* of approximately equal age, I disagree with Kelson (*loc. cit.*) on some of the characters which he used to separate *cultellus* from *internatus*. My findings indicate that *T. b. cultellus* is not smaller, that its skull is not smaller and not less angular, and that the tympanic bullae are not less pointed ventrally. Further collecting is needed better to limit and diagnose this subspecies.

Specimens examined.—Total 13. *Colorado*: Las Animas Co.: Fishers Peak, about 8000 ft., 1 (USNM). *New Mexico*: Union Co.: Near Folsom, 4 (CMNH); Colfax Co.: Philmont Ranch, Cimarroncito, 8100 ft., 2. Mora Co.: Halls Peak, 6 (USNM).

[pg 376]



FIGS. 2-7. Dorsal views of skulls of *Thomomys bottae*. × 1.

FIG. 2. *Thomomys b. aureus*, 3 mi. W Durango, La Plata Co., Colorado. No. 72967, ♀.

FIG. 3. *Thomomys b. howelli*, holotype, Grand Junction, 4600 ft., Mesa Co., Colorado. No. 75684 USNM, ♀.

FIG. 4. *Thomomys b. pervagus*, Espanola, 5000 ft., Rio Arriba Co., New Mexico. No. 133614 USNM, ♀.

FIG. 5. *Thomomys b. cultellus*, Fishers Peak, 8000 ft., Las Animas Co., Colorado. No. 129285 USNM, ♀.

FIG. 6. *Thomomys b. internatus*, Salida, 7050 ft., Chaffee Co., Colorado. No. 2757 ERW, ♀.

FIG. 7. *Thomomys b. rubidus*, holotype, 2-9/10 mi. E Cañon City, Fremont Co., Colorado. No. 72954, ♀.

***Thomomys bottae rubidus* new subspecies**

Holotype.—Adult female, skin and skull, number 72954, Museum of Natural History, University of Kansas, trapped by Richard S. Miller and Phillip M. Youngman, original number 253 (PMY), 2-9/10 miles east of Cañon City, 5344 feet, Fremont County, Colorado, March 17, 1957.

Distribution.—Known only from Garden Park in Cañon City and from the type locality (see fig. 1).

[pg 377]

Distinctive characters.—Dark (Reddish Brown 5YR 3/3); size large (see measurements); skull large; rostrum wide; zygomatic arches rounded and broadly spreading (see fig. 7); alveolar length of upper maxillary tooth-row small.

Comparisons.—From topotypes of *T. b. internatus*, *T. b. rubidus* differs as follows: uniformly darker; skull averages larger in all measurements, except alveolar length of upper maxillary tooth-row, which is smaller; rostrum proportionately wider and tapered anteriorly; zygomatic arches more rounded; bullae more rounded in lateral view.

Specimens of *T. b. rubidus* differ from topotypes of *T. b. pervagus* in darker color; rostrum wider posteriorly; posterior extensions of premaxillae shorter; bullae smaller, proportionately more inflated posteriorly; zygomatic arches more rounded; wider across squamosals; alveolar length of upper maxillary tooth-row greater.

From topotypes of *T. b. cultellus*, *T. b. rubidus* differs as follows: paler; larger in all measurements taken; rostrum proportionately wider; zygomatic arches more rounded,

less angular; angle formed by zygomatic arch and rostrum greater; bullae proportionately smaller, not so pointed anteriorly; alveolar length of upper maxillary tooth-row shorter.

Remarks.—The range of *T. b. rubidus* is surrounded by the range of *T. b. internatus*; nevertheless, intergradation has not been found. For a discussion of the geographic relation of *T. b. rubidus* to *T. b. internatus* see page 374.

Specimens examined.—Total 7. Fremont Co.: Garden Park, Cañon City, 5344 ft., 1; 2-9/10 mi. E Cañon City, 5344 ft., 6.

SUMMARY

A study of 249 specimens of *Thomomys bottae* from Colorado reveals six subspecies in the state. *T. b. aureus* and *T. b. howelli* occupy the Colorado Plateau Region in the western and southwestern parts of the state. *T. b. internatus*, *T. b. cultellus*, *T. b. pervagus*, and the newly named *T. b. rubidus* occupy part of the Southern Rocky Mountain Region and a narrow strip of the Great Plains.

The greatest amount of geographic variation, in *Thomomys bottae* in Colorado, occurs in the ecotone between the grassland and coniferous forest at the edge of the Great Plains, and in the ecotone between the Piñon, juniper, and sage of the Colorado Plateau and the Coniferous forest of the southern Rocky mountains.

TABLE 1. MEASUREMENTS, IN MILLIMETERS, OF THOMOMYS BOTTAE

[pg 378]

Unless otherwise noted, specimens are adults from Colorado

Sex	Catalog number or number of individuals averaged	Total length	Tail	Hind foot	Condylbasal length	Nasal length	Zygomatic breadth	Squamosal breadth	Length of rostrum	Breadth of rostrum	Alveolar length of upper max. tooth-row	Least interorbital breadth
<i>Thomomys bottae howelli</i> , holotype												
♀	75684 ^[1] sad.	219	71	29	37.3	11.1	23.7	20.0	14.5	8.5	7.7	6.6
<i>Thomomys bottae aureus</i> , Bedrock												
♀	2982 ^[2]	217	59	31	40.4	13.8	24.3	20.6	16.7	8.6	9.2	6.8
♀	3013 ^[2]	210	60	29	38.7	13.0	24.4	20.4	15.7	8.1	8.9	7.0
♂	2997 ^[2]	242	73	33	44.7	15.4	28.4	22.8	15.7	10.1	9.0	7.2
Coventry												
♀	6 av.	222	61	31	39.0	12.1	25.4	20.3	15.2	7.8	8.2	6.8
	Max.	229	63	33	40.0	12.8	25.8	20.6	15.6	8.2	8.5	7.0
	Min.	217	58	30	38.3	11.4	25.0	19.3	14.7	7.5	8.0	6.6
♂	3 av.	259	70	35	46.5	15.0	29.3	22.7	17.8	9.2	9.5	6.7
	Max.	270	76	36	48.3	16.0	31.9	23.7	18.0	9.3	9.6	6.9
	Min.	250	65	35	45.5	14.4	27.6	22.2	17.6	9.2	8.0	6.4
Ashbaugh's Ranch and 15 mi. W Cortez [pg 379]												
♀	7 av.	225	67	28	39.0	13.7	24.4	20.2	16.1	8.0	8.3	6.3
	Max.	238	75	31	40.6	14.7	25.0	20.7	16.5	8.5	8.7	6.8
	Min.	216	55	26	37.8	12.9	23.6	19.7	15.5	7.8	7.9	6.1
♂	4 av.	247	73	31	44.2	15.9	27.7	22.1	18.6	9.2	8.4	6.4
	Max.	252	80	34	45.2	16.7	28.8	22.3	19.8	9.6	8.8	6.7
	Min.	244	67	30	43.7	15.5	27.0	21.7	18.0	8.8	8.0	6.2
Cortez												
♀	5120 ^[3]	224	56	28	38.1	12.3	....	19.5	15.4	7.5	7.6	6.5
	5121 ^[3]	220	68	31	38.3	11.6	24.2	19.6	15.1	7.6	8.0	6.7
♂	5124 ^[3]	257	81	33	44.4	15.4	29.5	22.2	18.6	8.9	8.6	6.5
♂	5119 ^[3]	215	62	28	42.0	14.0	27.9	22.1	17.9	8.2	8.6	6.4
Mesa Verde (combined)												
♀	5 av.	221	63	30	39.0	12.6	24.7	20.2	16.0	8.0	8.2	6.7
	Max.	235	66	32	40.4	13.7	25.6	21.1	17.3	8.7	8.5	7.1
	Min.	212	61	28	38.1	12.0	24.1	19.5	15.0	7.7	7.9	6.4
♂	3 av.	246	74	32	43.7	14.9	27.8	22.3	18.3	8.8	8.9	6.6
	Max.	252	79	33	45.0	15.2	28.4	23.0	18.5	9.0	9.0	6.8
	Min.	238	69	31	42.0	14.7	27.5	21.2	18.2	8.7	8.9	6.3

		1 mi. N La Plata										
♂	72966 ^[4]	236	70	31	45.4	15.6	29.4	23.3	20.2	8.8	8.5	6.5
		3 mi. W Durango [pg 380]										
♀	3 av.	225	65	28	40.1	13.1	25.7	21.0	16.6	8.1	8.3	6.5
	Max.	230	67	29	40.4	13.5	25.8	21.2	16.8	8.4	8.5	6.6
	Min.	219	63	28	39.9	13.0	25.7	20.6	16.5	8.4	8.1	6.4
♂	70054 ^[4]	262	87	35	45.0	15.6	27.9	22.7	19.7	9.3	9.8	6.4
♂	70055 ^[4]	248	79	31	43.3	14.0	27.6	22.1	17.1	8.7	8.2	6.2
		12 mi. W Pagosa Springs										
♀	72971 ^[4]	217	65	27	39.1	12.8	....	20.0	15.4	7.4	8.7	6.2
♂	72970 ^[4]	238	70	29	42.7	15.0	27.5	21.8	17.2	8.8	8.3	6.5
		<i>Thomomys bottae pervagus</i> , Antonito										
♀	133668 ^[1] sad.	208	69	29	37.3	12.9	23.1	18.2	15.8	7.5	8.0	6.9
		Espanola, New Mexico [pg 381]										
♀	133616 ^[1]	249	82	38	41.1	....	24.6	20.0	16.3	8.2	8.1	7.1
♀	133619 ^[1]	216	65	32	40.6	....	24.9	19.3	....	8.0	8.0	6.8
♂	58293 ^[1]	244	76	31	44.0	16.1	26.9	21.2	18.3	8.8	8.1	6.6
		<i>Thomomys bottae internatus</i> , Salida										
♀	11 av.	219	67	31	38.6	13.4	23.2	19.5	15.4	7.6	7.8	6.5
	Max.	242	80	34	40.4	14.2	25.0	20.2	16.2	8.1	8.4	6.9
	Min.	196	45	29	37.6	12.9	21.9	18.8	14.8	7.3	7.0	6.3
♂	3 av.	247	74	32	42.9	16.1	25.1	20.9	18.0	8.2	8.0	6.3
	Max.	248	74	33	43.7	16.3	26.4	21.7	18.1	8.8	8.1	6.4
	Min.	247	74	32	42.2	15.9	25.8	20.5	17.9	7.9	7.9	6.3
		12 mi. N Cañon City										
♀	72945 ^[4]	230	81	28	38.1	13.0	22.6	19.4	15.0	7.9	8.0	6.7
♀	72947 ^[4]	228	74	27	38.7	14.0	23.6	19.8	15.9	8.2	8.1	6.8
		1 mi. W Coaldale										
♀	70042 ^[4]	224	70	30	38.1	13.1	23.5	19.5	15.6	7.7	7.5	6.6
		5 mi. S Cotopaxi										
♀	72932 ^[4]	224	65	27	39.1	13.8	24.3	20.4	15.5	7.7	7.5	6.5
♂	72925 ^[4]	250	74	29	44.0	16.2	27.5	22.8	18.7	9.0	8.1	6.1
		9 mi. SSW Colorado Springs [pg 382]										
♀	72942 ^[4]	225	77	29	38.8	14.1	23.3	20.2	15.4	7.8	8.3	6.7
	72943 ^[4]	219	70	28	37.7	13.5	23.0	19.7	14.8	7.6	8.4	6.8
		2-1/2 mi. S Wetmore										
♂	70053 ^[4]	250	81	30	42.5	16.7	26.3	22.3	17.7	8.5	7.9	5.9
		200 yards E St. Charles River, 8 mi. W Pueblo										
♀	73497 ^[4]	226	69	30	39.3	13.9	24.9	20.5	15.7	7.7	7.9	7.2
♀	73498 ^[4]	216	64	29	38.0	12.9	24.2	20.1	15.1	7.7	7.4	6.7
		St. Charles Mesa										
♀	4860 ^[3]	222	70	29	38.2	13.5	....	19.3	15.9	8.2	7.5	6.5
♂	4864 ^[3]	240	72	33	43.1	15.8	....	21.4	17.6	9.2	7.9	6.7
		11 mi. WNW Gardner [pg 383]										
♀	70052 ^[4]	227	64	28	37.9	13.0	22.5	18.8	14.8	7.3	8.0	6.7
		1-1/2 mi. S Redwing										
♀	72940 ^[4]	227	73	28	39.0	13.1	23.1	18.8	15.6	7.8	8.0	6.8
		1 mi. E La Veta										
♂	70049 ^[4]	254	88	32	42.4	15.1	27.5	21.8	17.3	8.4	8.2	6.5
♂	70044 ^[4]	239	80	32	42.3	16.5	27.8	22.0	17.9	8.7	8.1	6.4
		<i>Thomomys bottae cultellus</i> , Fishers Peak										
♀	129285 ^[1] sad.	214	64	27	37.2	13.0	....	19.0	15.3	7.7	7.6	6.5
		<i>Thomomys bottae rubidus</i> , holotype and topotypes										
♀	72952 ^[4]	233	80	28	40.6	14.2	25.1	20.8	16.7	8.8	7.5	6.9
♀	72954 ^[4]	225	80	28	40.3	14.2	24.6	20.6	16.6	9.2	7.2	6.9
♂	3 av.	261	89	31	44.7	15.7	27.8	22.6	18.6	10.1	7.4	6.9
	Max.	270	94	32	45.1	15.9	28.1	22.7	18.8	10.4	7.6	7.0
	Min.	255	85	30	44.2	15.5	27.5	22.5	18.5	9.8	7.2	6.8

sad. denotes subadult.

[1] United States National Museum.

[2] E. R. Warren Collection.

[3] Colorado State University.

[4] Museum of Natural History, University of Kansas.

[pg 384]

LITERATURE CITED

BAILEY, V.

1910. Two new pocket gophers of the genus *Thomomys*. Proc. Biol. Soc. Washington, 23:79-80, May 4.

1915. Revision of the pocket gophers of the genus *Thomomys*. U. S. Dept. Agric., Bur. Biol. Surv., N. Amer. Fauna, 39:1-136, 8 pls., 10 figs, in text, November 15.

DAUBENMIRE, R. F.

1943. Vegetational zonation in the Rocky Mountains. Bot. Rev., 9:325-393, June.

DURRANT, S. D.

1952. Mammals of Utah. Univ. Kansas Publ., Mus. Nat. Hist., 6:1-549, 91 figs. August 10.

FENNEMAN, N. M.

1931. Physiography of western United States. McGraw Hill Book Co., New York, xiii + 534 pp., 173 figs., 1 map in cover pocket.

GOLDMAN, E. A.

1936. *New pocket gophers of the genus Thomomys*. Jour. Washington Acad. Sci., 26(3):111-120, March 15.

GRINNELL, J.

1931. A new pocket gopher from southeastern California. Univ. California Publ. Zool., 38(1):1-10, 2 pls., October 17.

KELSON, K. R.

1951. Two new subspecies of *Thomomys bottae* from New Mexico and Colorado. Univ. Kansas Publ., Mus. Nat. Hist, 5(6):59-71, 1 fig. in text, October 1.

MUNSELL, A. H.

1954. Munsell soil color charts. Munsell Color Co., Inc., Baltimore.

Transmitted November 14, 1957.

□
27-1765

*** END OF THE PROJECT GUTENBERG EBOOK GEOGRAPHIC VARIATION IN THE POCKET GOPHER, THOMOMYS BOTTAE, IN COLORADO ***

Updated editions will replace the previous one—the old editions will be renamed.

Creating the works from print editions not protected by U.S. copyright law means that no one owns a United States copyright in these works, so the Foundation (and you!) can copy and distribute it in the United States without permission and without paying copyright royalties. Special rules, set forth in the General Terms of Use part of this license, apply to copying and distributing Project Gutenberg™ electronic works to protect the PROJECT GUTENBERG™ concept and trademark. Project Gutenberg is a registered trademark, and may not be used if you charge for an eBook, except by following the terms of the trademark license, including paying royalties for use of the Project Gutenberg trademark. If you do not charge anything for copies of this eBook, complying with the trademark license is very easy. You may use this eBook for nearly any purpose such as creation of derivative works, reports, performances and research. Project Gutenberg eBooks may be modified and printed and given away—you may do practically ANYTHING in the United States with eBooks not protected by U.S. copyright law. Redistribution is subject to the trademark license, especially commercial redistribution.

START: FULL LICENSE
THE FULL PROJECT GUTENBERG LICENSE
PLEASE READ THIS BEFORE YOU DISTRIBUTE OR USE THIS WORK

To protect the Project Gutenberg™ mission of promoting the free distribution of electronic works, by using or distributing this work (or any other work associated in any way with the phrase “Project Gutenberg”), you agree to comply with all the terms of the Full Project Gutenberg™ License available with this file or online at www.gutenberg.org/license.

Section 1. General Terms of Use and Redistributing Project Gutenberg™ electronic works

1.A. By reading or using any part of this Project Gutenberg™ electronic work, you indicate that you have read, understand, agree to and accept all the terms of this license and intellectual property (trademark/copyright) agreement. If you do not agree to abide by all the terms of this agreement, you must cease using and return or destroy all copies of Project Gutenberg™ electronic works in your possession. If you paid a fee for obtaining a copy of or access to a Project Gutenberg™ electronic work and you do not agree to be bound by the terms of this agreement, you may obtain a refund from the person or entity to whom you paid the fee as set forth in paragraph 1.E.8.

1.B. “Project Gutenberg” is a registered trademark. It may only be used on or associated in any way with an electronic work by people who agree to be bound by the terms of this agreement. There are a few things that you can do with most Project Gutenberg™ electronic works even without complying with the full terms of this agreement. See paragraph 1.C below. There are a lot of things you can do with Project Gutenberg™ electronic works if you follow the terms of this agreement and help preserve free future access to Project Gutenberg™ electronic works. See paragraph 1.E below.

1.C. The Project Gutenberg Literary Archive Foundation (“the Foundation” or PGLAF), owns a compilation copyright in the collection of Project Gutenberg™ electronic works. Nearly all the individual works in the collection are in the public domain in the United States. If an individual work is unprotected by copyright law in the United States and you are located in the United States, we do not claim a right to prevent you from copying, distributing, performing, displaying or creating derivative works based on the work as long as all references to Project Gutenberg are removed. Of course, we hope that you will support the Project Gutenberg™ mission of promoting free access to electronic works by freely sharing Project Gutenberg™ works in compliance with the terms of this agreement for keeping the Project Gutenberg™ name associated with the work. You can easily comply with the terms of this agreement by keeping this work in the same format with its attached full Project Gutenberg™ License when you share it without charge with others.

1.D. The copyright laws of the place where you are located also govern what you can do with this work. Copyright laws in most countries are in a constant state of change. If you are outside the United States, check the laws of your country in addition to the terms of this agreement before downloading, copying, displaying, performing, distributing or creating derivative works based on this work or any other Project Gutenberg™ work. The Foundation makes no representations concerning the copyright status of any work in any country other than the United States.

1.E. Unless you have removed all references to Project Gutenberg:

1.E.1. The following sentence, with active links to, or other immediate access to, the full Project Gutenberg™ License must appear prominently whenever any copy of a Project Gutenberg™ work (any work on which the phrase “Project Gutenberg” appears, or with which the phrase “Project Gutenberg” is associated) is accessed, displayed, performed, viewed, copied or distributed:

This eBook is for the use of anyone anywhere in the United States and most other parts of the world at no cost and with almost no restrictions whatsoever. You may copy it, give it away or re-use it under the terms of the Project Gutenberg License included with this eBook or online at www.gutenberg.org. If you are not located in the United States, you will have to check the laws of the country where you are located before using this eBook.

1.E.2. If an individual Project Gutenberg™ electronic work is derived from texts not protected by U.S. copyright law (does not contain a notice indicating that it is posted with permission of the copyright holder), the work can be copied and distributed to anyone in the United States without paying any fees or charges. If you are redistributing or providing access to a work with the phrase “Project Gutenberg” associated with or appearing on the work, you must comply either with the requirements of paragraphs 1.E.1 through 1.E.7 or obtain permission for the use of the work and the Project Gutenberg™ trademark as set forth in paragraphs 1.E.8 or 1.E.9.

1.E.3. If an individual Project Gutenberg™ electronic work is posted with the permission of the copyright holder, your use and distribution must comply with both paragraphs 1.E.1

through 1.E.7 and any additional terms imposed by the copyright holder. Additional terms will be linked to the Project Gutenberg™ License for all works posted with the permission of the copyright holder found at the beginning of this work.

1.E.4. Do not unlink or detach or remove the full Project Gutenberg™ License terms from this work, or any files containing a part of this work or any other work associated with Project Gutenberg™.

1.E.5. Do not copy, display, perform, distribute or redistribute this electronic work, or any part of this electronic work, without prominently displaying the sentence set forth in paragraph 1.E.1 with active links or immediate access to the full terms of the Project Gutenberg™ License.

1.E.6. You may convert to and distribute this work in any binary, compressed, marked up, nonproprietary or proprietary form, including any word processing or hypertext form. However, if you provide access to or distribute copies of a Project Gutenberg™ work in a format other than “Plain Vanilla ASCII” or other format used in the official version posted on the official Project Gutenberg™ website (www.gutenberg.org), you must, at no additional cost, fee or expense to the user, provide a copy, a means of exporting a copy, or a means of obtaining a copy upon request, of the work in its original “Plain Vanilla ASCII” or other form. Any alternate format must include the full Project Gutenberg™ License as specified in paragraph 1.E.1.

1.E.7. Do not charge a fee for access to, viewing, displaying, performing, copying or distributing any Project Gutenberg™ works unless you comply with paragraph 1.E.8 or 1.E.9.

1.E.8. You may charge a reasonable fee for copies of or providing access to or distributing Project Gutenberg™ electronic works provided that:

- You pay a royalty fee of 20% of the gross profits you derive from the use of Project Gutenberg™ works calculated using the method you already use to calculate your applicable taxes. The fee is owed to the owner of the Project Gutenberg™ trademark, but he has agreed to donate royalties under this paragraph to the Project Gutenberg Literary Archive Foundation. Royalty payments must be paid within 60 days following each date on which you prepare (or are legally required to prepare) your periodic tax returns. Royalty payments should be clearly marked as such and sent to the Project Gutenberg Literary Archive Foundation at the address specified in Section 4, “Information about donations to the Project Gutenberg Literary Archive Foundation.”
- You provide a full refund of any money paid by a user who notifies you in writing (or by e-mail) within 30 days of receipt that s/he does not agree to the terms of the full Project Gutenberg™ License. You must require such a user to return or destroy all copies of the works possessed in a physical medium and discontinue all use of and all access to other copies of Project Gutenberg™ works.
- You provide, in accordance with paragraph 1.F.3, a full refund of any money paid for a work or a replacement copy, if a defect in the electronic work is discovered and reported to you within 90 days of receipt of the work.
- You comply with all other terms of this agreement for free distribution of Project Gutenberg™ works.

1.E.9. If you wish to charge a fee or distribute a Project Gutenberg™ electronic work or group of works on different terms than are set forth in this agreement, you must obtain permission in writing from the Project Gutenberg Literary Archive Foundation, the manager of the Project Gutenberg™ trademark. Contact the Foundation as set forth in Section 3 below.

1.F.

1.F.1. Project Gutenberg volunteers and employees expend considerable effort to identify, do copyright research on, transcribe and proofread works not protected by U.S. copyright law in creating the Project Gutenberg™ collection. Despite these efforts, Project Gutenberg™ electronic works, and the medium on which they may be stored, may contain “Defects,” such as, but not limited to, incomplete, inaccurate or corrupt data, transcription errors, a copyright or other intellectual property infringement, a defective or damaged disk or other medium, a computer virus, or computer codes that damage or cannot be read by your equipment.

1.F.2. LIMITED WARRANTY, DISCLAIMER OF DAMAGES - Except for the “Right of Replacement or Refund” described in paragraph 1.F.3, the Project Gutenberg Literary Archive Foundation, the owner of the Project Gutenberg™ trademark, and any other party distributing a Project Gutenberg™ electronic work under this agreement, disclaim all liability to you for damages, costs and expenses, including legal fees. YOU AGREE THAT YOU HAVE NO REMEDIES FOR NEGLIGENCE, STRICT LIABILITY, BREACH OF WARRANTY OR BREACH OF CONTRACT EXCEPT THOSE PROVIDED IN PARAGRAPH 1.F.3. YOU AGREE THAT THE FOUNDATION, THE TRADEMARK OWNER, AND ANY DISTRIBUTOR UNDER

THIS AGREEMENT WILL NOT BE LIABLE TO YOU FOR ACTUAL, DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE OR INCIDENTAL DAMAGES EVEN IF YOU GIVE NOTICE OF THE POSSIBILITY OF SUCH DAMAGE.

1.F.3. LIMITED RIGHT OF REPLACEMENT OR REFUND - If you discover a defect in this electronic work within 90 days of receiving it, you can receive a refund of the money (if any) you paid for it by sending a written explanation to the person you received the work from. If you received the work on a physical medium, you must return the medium with your written explanation. The person or entity that provided you with the defective work may elect to provide a replacement copy in lieu of a refund. If you received the work electronically, the person or entity providing it to you may choose to give you a second opportunity to receive the work electronically in lieu of a refund. If the second copy is also defective, you may demand a refund in writing without further opportunities to fix the problem.

1.F.4. Except for the limited right of replacement or refund set forth in paragraph 1.F.3, this work is provided to you 'AS-IS', WITH NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PURPOSE.

1.F.5. Some states do not allow disclaimers of certain implied warranties or the exclusion or limitation of certain types of damages. If any disclaimer or limitation set forth in this agreement violates the law of the state applicable to this agreement, the agreement shall be interpreted to make the maximum disclaimer or limitation permitted by the applicable state law. The invalidity or unenforceability of any provision of this agreement shall not void the remaining provisions.

1.F.6. INDEMNITY - You agree to indemnify and hold the Foundation, the trademark owner, any agent or employee of the Foundation, anyone providing copies of Project Gutenberg™ electronic works in accordance with this agreement, and any volunteers associated with the production, promotion and distribution of Project Gutenberg™ electronic works, harmless from all liability, costs and expenses, including legal fees, that arise directly or indirectly from any of the following which you do or cause to occur: (a) distribution of this or any Project Gutenberg™ work, (b) alteration, modification, or additions or deletions to any Project Gutenberg™ work, and (c) any Defect you cause.

Section 2. Information about the Mission of Project Gutenberg™

Project Gutenberg™ is synonymous with the free distribution of electronic works in formats readable by the widest variety of computers including obsolete, old, middle-aged and new computers. It exists because of the efforts of hundreds of volunteers and donations from people in all walks of life.

Volunteers and financial support to provide volunteers with the assistance they need are critical to reaching Project Gutenberg™'s goals and ensuring that the Project Gutenberg™ collection will remain freely available for generations to come. In 2001, the Project Gutenberg Literary Archive Foundation was created to provide a secure and permanent future for Project Gutenberg™ and future generations. To learn more about the Project Gutenberg Literary Archive Foundation and how your efforts and donations can help, see Sections 3 and 4 and the Foundation information page at www.gutenberg.org.

Section 3. Information about the Project Gutenberg Literary Archive Foundation

The Project Gutenberg Literary Archive Foundation is a non-profit 501(c)(3) educational corporation organized under the laws of the state of Mississippi and granted tax exempt status by the Internal Revenue Service. The Foundation's EIN or federal tax identification number is 64-6221541. Contributions to the Project Gutenberg Literary Archive Foundation are tax deductible to the full extent permitted by U.S. federal laws and your state's laws.

The Foundation's business office is located at 809 North 1500 West, Salt Lake City, UT 84116, (801) 596-1887. Email contact links and up to date contact information can be found at the Foundation's website and official page at www.gutenberg.org/contact

Section 4. Information about Donations to the Project Gutenberg Literary Archive Foundation

Project Gutenberg™ depends upon and cannot survive without widespread public support and donations to carry out its mission of increasing the number of public domain and licensed works that can be freely distributed in machine-readable form accessible by the widest array of equipment including outdated equipment. Many small donations (\$1 to \$5,000) are particularly important to maintaining tax exempt status with the IRS.

The Foundation is committed to complying with the laws regulating charities and charitable donations in all 50 states of the United States. Compliance requirements are not uniform and it takes a considerable effort, much paperwork and many fees to meet and keep up with these

requirements. We do not solicit donations in locations where we have not received written confirmation of compliance. To SEND DONATIONS or determine the status of compliance for any particular state visit www.gutenberg.org/donate.

While we cannot and do not solicit contributions from states where we have not met the solicitation requirements, we know of no prohibition against accepting unsolicited donations from donors in such states who approach us with offers to donate.

International donations are gratefully accepted, but we cannot make any statements concerning tax treatment of donations received from outside the United States. U.S. laws alone swamp our small staff.

Please check the Project Gutenberg web pages for current donation methods and addresses. Donations are accepted in a number of other ways including checks, online payments and credit card donations. To donate, please visit: www.gutenberg.org/donate

Section 5. General Information About Project Gutenberg™ electronic works

Professor Michael S. Hart was the originator of the Project Gutenberg™ concept of a library of electronic works that could be freely shared with anyone. For forty years, he produced and distributed Project Gutenberg™ eBooks with only a loose network of volunteer support.

Project Gutenberg™ eBooks are often created from several printed editions, all of which are confirmed as not protected by copyright in the U.S. unless a copyright notice is included. Thus, we do not necessarily keep eBooks in compliance with any particular paper edition.

Most people start at our website which has the main PG search facility: www.gutenberg.org.

This website includes information about Project Gutenberg™, including how to make donations to the Project Gutenberg Literary Archive Foundation, how to help produce our new eBooks, and how to subscribe to our email newsletter to hear about new eBooks.